CLAIMS

1. An interleaver comprising:

a birefringent element assembly comprising at least one spatial birefringent element, the birefringent element assembly providing two output components; and

a reflector configured to direct the two components from the birefringent element assembly back through the birefringent element assembly.

2. The interleaver as recited in claim 1, further comprising a polarization rotator configured to make the two components approximately the same in polarization with respect to one another prior to the two components being transmitted back through the birefringent element assembly.

3. The interleaver as recited in claim 1, wherein the reflector comprises a prism.

4. The interleaver as recited claim 1, wherein the reflector comprises a mirror.

5. The interleaver as recited in claim 2, wherein the polarization rotator comprises a half-wave waveplate.

6. The interleaver as recited in claim 1, wherein the reflector comprises a mirror and a quarter-wave waveplate.

7. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises a plurality of spatial birefringent elements.

8. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises a first birefringent element having an equivalent angular orientation

of φ_1, a second birefringent element having an equivalent angular orientation of φ_2 and a third birefringent element having an equivalent angular orientation of φ_3;

wherein an order of the first birefringent element, second birefringent element, and third birefringent element is selected from the group consisting of:

first birefringent element, second birefringent element, third birefringent element;

third birefringent element, second birefringent element, first birefringent element; and

wherein the equivalent angular orientations are with respect to an equivalent polarization direction of light entering the birefringent element assembly.

9. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises:

a first birefringent element having an equivalent angular orientation of 45° and having a phase delay of Γ;

a second birefringent element having an equivalent angular orientation of -21° and having a phase delay of 2Γ; and

a third birefringent element having an equivalent angular orientation of 7° and having a phase delay of 2Γ.

10. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises two birefringent elements.

11. The interleaver as recited in claim 1, wherein the birefringent element assembly comprises:

a first birefringent element having an equivalent angular orientation of 45° and having a phase delay of Γ; and

a second birefringent element having an equivalent angular orientation of -21° and having a phase delay of 2Γ.

12. The interleaver as recited in claim 1, wherein the birefringent element assembly and the reflector are configured so as to facilitate interleaving of a plurality of input light beams simultaneously.

13. The interleaver as recited in claim 1, wherein each spatial birefringent element defines two light paths, each light path having a different optical path length and wherein a difference in optical path length between the two paths is provided by a material having an index of refraction greater than one which is disposed within at least a portion of one of the first and second paths.

14. The interleaver as recited in claim 1, wherein each spatial birefringent element defines two light paths and wherein an index of refraction is different for at least a portion of at least one of the two light paths so as to cause the two light paths to have different optical path lengths.

15. The interleaver as recited in claim 1, wherein the interleaved channels have spacing which is tunable.

16. A birefringent element assembly comprising:

at least one spatial birefringent element; and

a polarization rotator for controlling an equivalent angle of the birefringent element assembly.

17. The birefringent element assembly as recited in claim 16, wherein the polarization rotator comprises a half-wave waveplate.

18. A method for interleaving, the method comprising:

transmitting light through a birefringent element assembly comprised of at least one spatial birefringent element, the birefringent element assembly separating the light into first and second components;

making the two components approximately the same in polarization with respect to one another; and

transmitting the first and second components back through the birefringent element assembly.

19. The method as recited in claim 18, wherein aligning the first and second components such that the polarization directions of the first and second components are approximately parallel with respect to one another comprises aligning the first and second components such that the first and second components are approximately orthogonal with respect to a polarization direction of light input to the birefringent element assembly.

20. A method for interleaving, the method comprising:

transmitting light along a path in a first direction and providing two interleaved output components;

making the polarization of the two components approximately the same with respect to one another;

transmitting light substantially along the same path in a second direction; and

wherein the second direction is generally opposite with respect to the first direction and dispersion introduced when light is transmitted in the first direction is substantially cancelled when light is transmitted in the second direction.

21. A method for interleaving, the method comprising transmitting light through a birefringent device in two generally opposite directions.

22. A method for interleaving, the method comprising transmitting light through a spatial birefringent device in two generally opposite directions.

23. A method for achieving a birefringent effect, the method comprising defining a birefringent effect by defining a polarization direction of light input to an optical polarizing device.

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